

fishermen. Hurricanes may also redistribute fish or cause them to migrate, also affecting fishermen's harvest.

Occasionally, environmental conditions could be right for a hurricane to cause a lasting impact on a particular fishery. The 1999 hurricane season was likely a contributor to the significant decline in hard blue crab landings observed following 1999 and left a lasting impression that persisted throughout the end of the time series. The 1999 hurricane season was the only season found to coincide with the decline seen in the hard blue crab fishery; however, since the hard blue crab fishery is the largest and most economically important fishery in the state of North Carolina, any factors that could potentially negatively influence this fishery are cause for concern.

The red tide of 1987-88 decreased bay scallop population levels below a minimum stock size threshold that is needed to maintain recruitment levels large enough to supply adequate numbers of larvae for the next generation. Bay scallop populations are likely currently at such low levels that any external influence such as hurricanes, habitat loss, poor water quality, or predators increases the vulnerability of the population. They may continue to be negatively affected by environmental disturbances (including hurricanes) until the spawning stock can reach large enough levels to overcome these events as they have in the past.

Fisheries that occur primarily in the fall during the peak of hurricane season, such as striped mullet and the southern flounder pound net fishery, have a large risk for a reduction in overall harvest. The striped mullet fishery likely suffers, not from a stock reduction, but simply from the inability of fishermen to harvest striped mullet roe during the peak of the season causing short-term impacts to landings.

This study also provides evidence that hurricanes may impact estuarine and nearshore commercial fisheries (e.g., hard blue crabs, bay scallops, and striped mullet) more than offshore fisheries (e.g., groupers). In addition, the hard clam fishery may experience short-term decreases in landings due to shellfish closures associated with fecal coliform runoff, particularly during years in which there are multiple storm events.

## **Forecasting**